Principal Components Analysis of 4 band satellite imagery for Wat Phu, Champasak, Lao PDR.

Geog 4/586 - crn:
Lecture - Tu and Th 9-9:50 in 175 Lillis  
Lab - Tu 10-11:50 in McKenzie 442 (SSIL)
Instructor - Dr. Nicholas Kohler  
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Prerequisite: Geog 4/585 or equivalent (such as Geog481) with instructor consent

Lidar point cloud profile in Honolua Bay, Maui, Hawaii

This course explore applications of remote sensing across the human and natural sciences. The explosion of information and techniques available to monitor the environment have revolutionized business practices and scientific understanding in fields including landscape management, disaster response, and urban planning. Data sources such as Structure-from-motion and Lidar point clouds, thermal, 
multispectral and hyperspectral imagery - are used in applications ranging from global environmental monitoring to detailed local surface analysis.

The class familiarizes students to the variety of data sources available with contemporary remote sensing technologies and the associated techniques to visualize, analyze, and present this data. The lectures and lab sessions cover data preprocessing and enhancement, data classification, environmental measurement and the visualization of analysis results.

Outcomes and Learning Objectives

By the end of the class students should:

- know the differences between the major types of remote sensing data types (multispectral digital images, lidar and structure from motion point clouds, radar and hyperspectral) and sources (aircraft, satellites, drones (UAVs), historic imagery, global remote sensing data archives).
- Develop familiarity with appropriate processing and analysis methods for applications
using this data, and
  - be able to clearly present the results of short labs and a longer analysis project.

Due to the varied nature of remote sensing data and analysis, a variety of software tools will be used in the labs, such as ArcGIS, QGIS, Fusion Lidar, Photoscan Structure-from-Motion, and the R and Python programming languages.

As part of the coursework for Winter Term 2017, the class will work with the SCYP program on an applied project for the city of Albany, Oregon. The project is focused on the management and use of parks and recreational facilities in the city, as well as potential applications for a variety of other ongoing projects for the city. Students will develop an overview of existing remote sensing resources and plan for future data collection opportunities. This will involve the creation a historical orthophoto and elevation model of Albany using imagery from the 1930s and structure-from-motion technology, the development of a present-day elevation dataset of the city using Lidar data, and an overview of the potential of emerging technologies (such as drones and near-ground level data collection) for parks management and community education.

![Printable 3d model of Lanai, Hawaii](image)

Grading:

Grading is based on short lecture exercises or take-home exercises, longer lab assignments which apply the topics presented in lectures and readings, and tests on material covered in class lectures, readings, and lab work.

- **In Geog 486:**
  - *Lecture exercises* and *tests* comprise 50% of the final grade
  - *Lab assignments* make up the remaining 50% of the grade (including final project)

- **In Geog 586:**
  - *Lecture exercises* and *tests* comprise 50% of the final grade
  - *Lab assignments* make up 40% of the grade for graduates.
  - *Final project* - (10%) Graduate students will produce a small final project and project write-up that makes up 10% of their grade. This will review research articles on a specific application topic (ideally related to the graduate project), have at least 5 references, and follow standard formatting guidelines.
Labs and Lab Grades

Laboratory sessions will be in SSIL. Labs must be turned in on the day they are assigned -- otherwise you will receive half-credit on the assignment unless you have made arrangements beforehand. You are encouraged to collaborate on labs and help one another out, but do not copy each others’ written answers. Labs are due electronically in PDF format.

Readings and materials

On-line materials, technical guides, and research articles will comprise the bulk the course readings. Labs and additional readings are provided on the course website at canvas.uoregon.edu

Term Overview

Weeks:

- **1-3**: Digital topography and 3d Modeling using Lidar, structure-from-motion, and photogrammetric methods; geometric preprocessing.
- **3-5**: Spectral preprocessing and data fusion; Hyperspectral data analysis
- **6-8**: Change detection with Global Datasets
- **8-10**: SCYP Project Wrap-up